

WHAT IS CLAIMED IS:

1. A method for determining lattice points to be referenced to prepare correspondence defining data that defines correspondence between the amount of each ink used by the printing apparatus and the color component value in a color system, said method comprising:  
referencing the original correspondence defining data which previously prescribes correspondence between the lattice points in the low-dimensional color space prescribed by less color components than the number of inks and the lattice points for ink amount in the ink amount space, thereby acquiring correspondence between the lattice points in the low-dimensional color space and the lattice points in the device-independent color space;  
prescribing a smoothness evaluation function which evaluates the smoothness of arrangement of lattice points in the device-independent color space and contains a constraint condition that the arrangement of lattice points becomes nonuniform at a certain position in the device-independent color space and which has as a variable the lattice point position information in the low-dimensional color space;  
optimizing the arrangement of lattice points in the device-independent color-space by improving the rating of the smoothness evaluation function, with the lattice point position information in the low-dimensional color space varied; and  
referencing the original correspondence defining data,

thereby associating the amount of each ink corresponding to the lattice points in the low-dimensional color space in the optimized state with the lattice points in the low-dimensional color space prescribed by the original correspondence defining data.

2. The method for determining lattice points to be referenced to prepare the correspondence defining data as defined in Claim 1, wherein the smoothness evaluation function is a function which contains the absolute value of the sum of the terms multiplied by a different weighting factor for each of the vectors which are oriented toward the adjacent lattice points adjacent to the lattice point to be optimized and which are also oriented in the mutually opposite directions.

3. The method for determining lattice points to be referenced to prepare the correspondence defining data as defined in Claim 1, wherein said weighting factors are values varying for each region in the color gamut to which the lattice point to be optimized belongs.

4. The method for determining lattice points to be referenced to prepare the correspondence defining data as defined in Claim 2, wherein the weighting factor to be multiplied to one of the vectors is smaller than the weighting factor to be multiplied to the other vector when one of the vectors is larger than the other vector.

5. The method for determining lattice points to be referenced to prepare the correspondence defining data as

defined in Claim 2, wherein the weighting factor to be multiplied to each vector in the opposite direction is inversely proportional to the distance between the low-dimensional color lattice points corresponding to the end points of each vector.

6. An apparatus for determining lattice points to be referenced to prepare correspondence defining data that defines correspondence between the amount of each ink used by the printing apparatus and the color component value in a color system, said apparatus comprising:

a unit to record the original correspondence defining data which previously prescribes correspondence between the lattice points in the low-dimensional color space prescribed by less color components than the number of inks and the lattice points for ink amount in the ink amount space;

a unit to acquire correspondence between the lattice points in the low-dimensional color space and the lattice points in the device-independent color space by referencing the original correspondence defining data;

a unit to calculate a smoothness evaluation function which evaluates the smoothness of arrangement of lattice points in the device-independent color space and contains a constraint condition that the arrangement of lattice points becomes nonuniform at a certain position in the device-independent color space and which has as a variable the lattice point position information in the low-dimensional

color space;

a unit to optimize the arrangement of lattice points in the device-independent color-space by improving the rating of the smoothness evaluation function, with the lattice point position information in the low-dimensional color space varied; and

a unit to reference the original correspondence defining data, thereby associating the amount of each ink corresponding to the lattice points in the low-dimensional color space in the optimized state with the lattice points in the low-dimensional color space prescribed by the original correspondence defining data.

7. A program product which enables the computer to realize the capability of determining lattice points to be referenced to prepare correspondence defining data that defines correspondence between the amount of each ink used by the printing apparatus and the color component value in a color system, said program product comprising:

a feature to record in a prescribed recording medium the original correspondence defining data which previously prescribes correspondence between the lattice points in the low-dimensional color space prescribed by less color components than the number of inks and the lattice points for ink amount in the ink amount space and to acquire correspondence between the lattice points in the low-dimensional color space and the lattice points in the device-independent color space by referencing the original correspon-

dence defining data;

a feature to calculate a smoothness evaluation function which evaluates the smoothness of arrangement of lattice points in the device-independent color space and contains a constraint condition that the arrangement of lattice points becomes nonuniform at a certain position in the device-independent color space and which has as a variable the lattice point position information in the low-dimensional color space;

a feature to optimize the arrangement of lattice points in the device-independent color-space by improving the rating of the smoothness evaluation function, with the lattice point position information in the low-dimensional color space varied; and

a feature to reference the original correspondence defining data, thereby associating the amount of each ink corresponding to the lattice points in the low-dimensional color space in the optimized state with the lattice points in the low-dimensional color space prescribed by the original correspondence defining data.

8. A print controlling apparatus for generating the printing data which permit printing by referencing correspondence defining data that defines correspondence between the amount of each ink used by the printing apparatus and the color component value in a color system and converting the color component value in the color system into the amount of ink, which is characterized in that:

the correspondence defining data is one which is prepared by referencing the original correspondence defining data which previously prescribes correspondence between the lattice points in the low-dimensional color space prescribed by less color components than the number of inks and the lattice points for ink amount in the ink amount space, thereby acquiring correspondence between the lattice points in the low-dimensional color space and the lattice points in the device-independent color space, prescribing a smoothness evaluation function which evaluates the smoothness of arrangement of lattice points in the device-independent color space and contains a constraint condition that the arrangement of lattice points becomes nonuniform at a certain position in the device-independent color space and which has as a variable the lattice point position information in the low-dimensional color space, optimizing the arrangement of lattice points in the device-independent color-space by improving the rating of the smoothness evaluation function, with the lattice point position information in the low-dimensional color space varied, referencing the original correspondence defining data, thereby associating the amount of each ink corresponding to the lattice points in the low-dimensional color space in the optimized state with the lattice points in the low-dimensional color space prescribed by the original correspondence defining data to establish the lattice points for preparing the correspondence defining data, and associating

the amount of ink with the color component value in the other color system by means of the colorimetric value measured by using a prescribed colorimetry for the result of printing with the amount of ink prescribed by the lattice points to be referenced to prepare the correspondence defining data.

9. A print controlling method for generating the printing data which permit printing by referencing correspondence defining data that defines correspondence between the amount of each ink used by the printing apparatus and the color component value in a color system and converting the color component value in the color system into the amount of ink, which is characterized in that:  
the correspondence defining data is one which is prepared by referencing the original correspondence defining data which previously prescribes correspondence between the lattice points in the low-dimensional color space prescribed by less color components than the number of inks and the lattice points for ink amount in the ink amount space, thereby acquiring correspondence between the lattice points in the low-dimensional color space and the lattice points in the device-independent color space, prescribing a smoothness evaluation function which evaluates the smoothness of arrangement of lattice points in the device-independent color space and contains a constraint condition that the arrangement of lattice points becomes nonuniform at a certain position in the device-independent color space

and which has as a variable the lattice point position information in the low-dimensional color space, optimizing the arrangement of lattice points in the device-independent color-space by improving the rating of the smoothness evaluation function, with the lattice point position information in the low-dimensional color space varied, referencing the original correspondence defining data, thereby associating the amount of each ink corresponding to the lattice points in the low-dimensional color space in the optimized state with the lattice points in the low-dimensional color space prescribed by the original correspondence defining data to establish the lattice points for preparing the correspondence defining data, and associating the amount of ink with the color component value in the other color system by means of the colorimetric value measured by using a prescribed colorimetry for the result of printing with the amount of ink prescribed by the lattice points to be referenced to prepare the correspondence defining data.

10. A print controlling program product which enables the computer to realize the capability of generating the printing data which permit printing by referencing correspondence defining data that defines correspondence between the amount of each ink used by the printing apparatus and the color component value in a color system and converting the color component value in the color system into the amount of ink, which is characterized in that:



the correspondence defining data is one which is prepared by referencing the original correspondence defining data which previously prescribes correspondence between the lattice points in the low-dimensional color space prescribed by less color components than the number of inks and the lattice points for ink amount in the ink amount space, thereby acquiring correspondence between the lattice points in the low-dimensional color space and the lattice points in the device-independent color space, prescribing a smoothness evaluation function which evaluates the smoothness of arrangement of lattice points in the device-independent color space and contains a constraint condition that the arrangement of lattice points becomes nonuniform at a certain position in the device-independent color space and which has as a variable the lattice point position information in the low-dimensional color space, optimizing the arrangement of lattice points in the device-independent color-space by improving the rating of the smoothness evaluation function, with the lattice point position information in the low-dimensional color space varied, referencing the original correspondence defining data, thereby associating the amount of each ink corresponding to the lattice points in the low-dimensional color space in the optimized state with the lattice points in the low-dimensional color space prescribed by the original correspondence defining data to establish the lattice points for preparing the correspondence defining data, and associating

the amount of ink with the color component value in the color system by means of the colorimetric value measured by using a prescribed colorimetry for the result of printing with the amount of ink prescribed by the lattice points to be referenced to prepare the correspondence defining data.

11. A color converting apparatus which references correspondence defining data that defines correspondence between the amount of each ink used by the printing apparatus and the color component value in a color system, thereby converting the color component value in the color system into the amount of ink, which is characterized in that: the correspondence defining data is one which is prepared by referencing the original correspondence defining data which previously prescribes correspondence between the lattice points in the low-dimensional color space prescribed by less color components than the number of inks and the lattice points for ink amount in the ink amount space, thereby acquiring correspondence between the lattice points in the low-dimensional color space and the lattice points in the device-independent color space, prescribing a smoothness evaluation function which evaluates the smoothness of arrangement of lattice points in the device-independent color space and contains a constraint condition that the arrangement of lattice points becomes nonuniform at a certain position in the device-independent color space and which has as a variable the lattice point position information in the low-dimensional color space, optimizing

the arrangement of lattice points in the device-independent color-space by improving the rating of the smoothness evaluation function, with the lattice point position information in the low-dimensional color space varied, referencing the original correspondence defining data, thereby associating the amount of each ink corresponding to the lattice points in the low-dimensional color space in the optimized state with the lattice points in the low-dimensional color space prescribed by the original correspondence defining data to establish the lattice points for preparing the correspondence defining data, and associating the amount of ink with the color component value in the other color system by means of the colorimetric value measured by using a prescribed colorimetry for the result of printing with the amount of ink prescribed by the lattice points to be referenced to prepare the correspondence defining data.

12. A color converting method which references correspondence defining data that defines correspondence between the amount of each ink used by the printing apparatus and the color component value in a color system, thereby converting the color component value in the color system into the amount of ink, which is characterized in that: the correspondence defining data is one which is prepared by referencing the original correspondence defining data which previously prescribes correspondence between the lattice points in the low-dimensional color space pre-

scribed by less color components than the number of inks and the lattice points for ink amount in the ink amount space, thereby acquiring correspondence between the lattice points in the low-dimensional color space and the lattice points in the device-independent color space, prescribing a smoothness evaluation function which evaluates the smoothness of arrangement of lattice points in the device-independent color space and contains a constraint condition that the arrangement of lattice points becomes nonuniform at a certain position in the device-independent color space and which has as a variable the lattice point position information in the low-dimensional color space, optimizing the arrangement of lattice points in the device-independent color-space by improving the rating of the smoothness evaluation function, with the lattice point position information in the low-dimensional color space varied, referencing the original correspondence defining data, thereby associating the amount of each ink corresponding to the lattice points in the low-dimensional color space in the optimized state with the lattice points in the low-dimensional color space prescribed by the original correspondence defining data to establish the lattice points for preparing the correspondence defining data, and associating the amount of ink with the color component value in the other color system by means of the colorimetric value measured by using a prescribed colorimetry for the result of printing with the amount of ink prescribed by the lattice

points to be referenced to prepare the correspondence defining data.

13. A color converting program product which references correspondence defining data that defines correspondence between the amount of each ink used by the printing apparatus and the color component value in a color system, thereby converting the color component value in the color system into the amount of ink, which is characterized in that:

the correspondence defining data is one which is prepared by referencing the original correspondence defining data which previously prescribes correspondence between the lattice points in the low-dimensional color space prescribed by less color components than the number of inks and the lattice points for ink amount in the ink amount space, thereby acquiring correspondence between the lattice points in the low-dimensional color space and the lattice points in the device-independent color space, prescribing a smoothness evaluation function which evaluates the smoothness of arrangement of lattice points in the device-independent color space and contains a constraint condition that the arrangement of lattice points becomes nonuniform at a certain position in the device-independent color space and which has as a variable the lattice point position information in the low-dimensional color space, optimizing the arrangement of lattice points in the device-independent color-space by improving the rating of the smoothness

evaluation function, with the lattice point position information in the low-dimensional color space varied, referencing the original correspondence defining data, thereby associating the amount of each ink corresponding to the lattice points in the low-dimensional color space in the optimized state with the lattice points in the low-dimensional color space prescribed by the original correspondence defining data to establish the lattice points for preparing the correspondence defining data, and associating the amount of ink with the color component value in the other color system by means of the colorimetric value measured by using a prescribed colorimetry for the result of printing with the amount of ink prescribed by the lattice points to be referenced to prepare the correspondence defining data.